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Proposed Remedial Action Plan for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

January 2004

INTRODUCTION

The U.S. Department of Energy (DOE) is conducting cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP), Paducah, Kentucky, under its Environmental Management Program to address contamination resulting from past waste-handling and disposal practices at the plant. The site cleanup strategy includes a series of actions. As part of this cleanup action, DOE, the U.S. Environmental Protection Agency (EPA), and the Commonwealth of Kentucky's Department for Environmental Protection (KDEP) request public review and comment on this Proposed Remedial Action Plan (PRAP) for source reduction of the volatile organic compound (VOC) contamination at the C-400 Cleaning Building (C-400), which is part of the Groundwater Operable Unit (GWOU). DOE is the lead agency for conducting this action.

DOE has considered remedial actions for a source reduction action for the VOC contamination at C-400. These include the following: (1) no action; (2) limited action consisting of enhanced institutional controls to prevent human exposure to the VOCs, five-year reviews, and no additional contaminant removal; (3) direct heating; and (4) a combination of vapor extraction and steam extraction. Alternative 3 has been selected as the preferred action for the VOC contamination at C-400. Selection of the proposed action is based upon the "Feasibility Study for the Groundwater Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/OR/07-1857&D2 (FS), dated August 2001, and results from the "2003 Six-Phase Heating Treatability Study Final Report at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/OR/07-2113&D0.

This plan fulfills the public participation requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980; the Resource Conservation and Recovery Act (RCRA) of 1976; Kentucky Revised Statute 224.46-530(1); and the National Environmental Policy Act (NEPA) of 1969 by summarizing the FS and requesting public comments on the alternatives identified. This PRAP also serves as a "Statement of Basis" for the modification to the Kentucky Hazardous Waste Management Permit, KY8-890-008-982.

Since the GWOU is extensive, multiple actions are anticipated. The GWOU strategy includes a phased approach consisting of the following steps: (1) prevention of human exposure; (2) reduction, control, or minimization of major groundwater source areas contributing to off-site contamination; and (3) evaluation and selection of long-term solutions for the off-site dissolved-phase groundwater plumes and remaining groundwater sources. Early actions already have been implemented to prevent exposure and to reduce further off-site migration of contaminant plumes, including implementation of the DOE Water Policy and construction of and on-going operation of the groundwater treatment systems for the Northwest and Northeast Plumes. The short-term goal is to accelerate reduction of groundwater source areas (i.e., *C-400 and the Southwest Plume source[s]). This Plan focuses on VOC source reduction in the soils of the Upper Continental Recharge System (UCRS) and Regional Gravel Aquifer (RGA) at C-400. This area is located on-site within the plant secured area.*

DOE, EPA, and KDEP encourage public review and comment on the proposal for a preferred alternative for addressing the VOC contamination at C-400. This plan has been prepared for the public to provide information and to solicit public comment on the preferred alternative for addressing the VOC contamination at C-400, as well as on the other alternatives considered. This plan provides a summary of the information presented in the "Feasibility Study for the Groundwater Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/OR/07-1857&D2, which also is available for public review. The preferred alternative represents a recommendation by DOE, subject to public comment. The final remedial action selected in the Record of Decision (ROD) may be different from the preferred alternative presented in this document, depending upon public comments. The public comment period will be scheduled after approval of this PRAP. The "Responsiveness Summary" section of the ROD will address significant public comments received on this PRAP. Public comments also will become part of the record of modification for the Kentucky Hazardous Waste Management Permit, KY8-890-008-982. Additional information regarding the public participation process and the public meeting can be found in the "Community Participation" section of this PRAP.

SITE BACKGROUND

PGDP is located in McCracken County in western Kentucky, about 6.5 km (4 miles) south of the Ohio River and approximately 16 km (10 miles) west of the city of Paducah.

It is an operating uranium enrichment facility owned by DOE. DOE currently leases the plant production operation facilities to the United States Enrichment Corporation. Bechtel Jacobs Company LLC is DOE's management and integration contractor for the environmental restoration and waste management activities at the plant.

The C-400 Cleaning Building is located inside the plant secured area, near the center of the industrial section of PGDP. The building is bound by 10^{th} and 11^{th} Streets to the west and east, respectively, and by Virginia and Tennessee Avenues to the north and south, respectively. Figure 1 shows the location of C-400.

Historically, some of the primary activities associated with C-400 are cleaning machinery parts, disassembling and testing of cascade components, and laundering plant clothes. The building also has housed various other activities, including recovery of precious metals and treatment of radiological waste streams.

Suspected sources of leaks and spills at C-400 include (1) degreaser and cleaning tank pits, (2) drains and sewers, (3) the east side plenum/fan room basement, (4) tanks and sumps outside the building, and (5) various first-floor C-400 processes. These sources have resulted in contamination of soil and groundwater by VOCs (primarily trichloroethene [TCE] and its breakdown products), semivolatile organic compounds (SVOCs), and various metals and radionuclides.

The two most significant sources of leaks and spills of VOCs that have been identified are located at the southeast corner of the building. This is where a drain line from the degreaser sump was connected to a storm sewer and also where the transfer pumps and piping delivered solvents to and from storage to processes in the building.

In June 1986, a routine construction excavation along the 11^{th} Street storm sewer revealed TCE soil contamination. The cause of the contamination was determined to be a leak in a drain line from the building's basement sump to the storm sewer. The area of contamination became known as the C-400 Trichloroethene Leak Site and was given the designation of Solid Waste Management Unit (SWMU) 11. After the initial discovery of contamination, four borings were installed to better define the extent of the soil contamination. SWMU 11 and the C-400 area have been the subjects of several investigations since then.

The Phase I and Phase II CERCLA Site Investigations included the C-400 area within their scope, with the installation of soil borings and groundwater monitoring wells. These investigations confirmed that TCE contamination at the southeast corner of C-400 extended from the surface to the base of the RGA at 92 ft below ground surface (bgs). In 1995, the Phase IV Investigation demonstrated that the C-400 area was a potential major source for the Northwest Plume. Also in 1995, a review of C-400 activities was completed

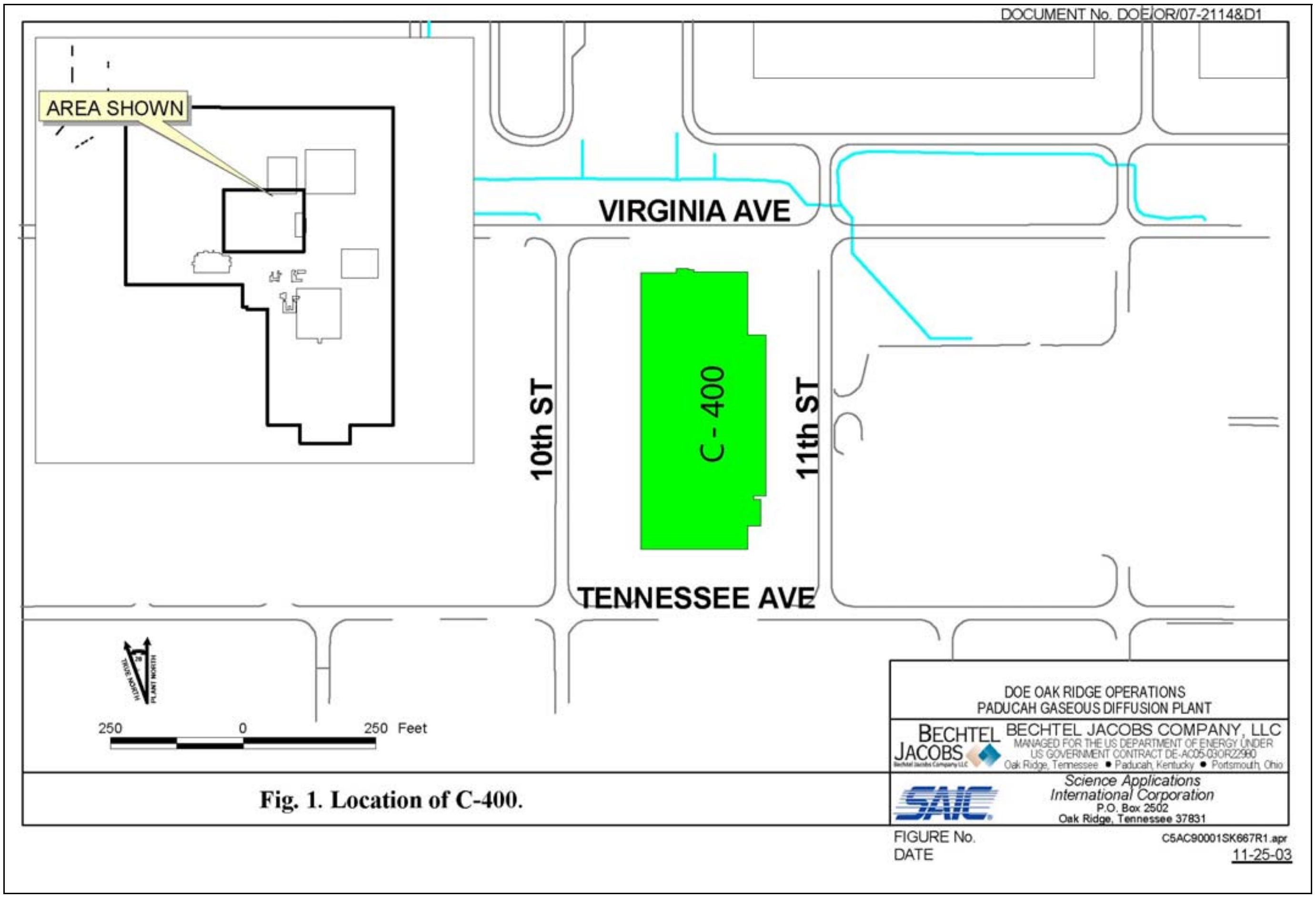


Fig. 1. Location of C-400.

and documented in *C-400 Process and Structure Review*, KY/ERWM-38.

In 1997, the Waste Area Grouping (WAG) 6 Remedial Investigation (RI) focused on the C-400 area, further delineating contamination at SWMU 11. The RI identified the TCE transfer system at the southeast corner of the building as a significant source of soil and groundwater contamination. An additional area of VOC soil contamination was identified near the southwest corner of the building, associated with a storm sewer. Other areas of various types of contamination also were identified. The results of the investigation are documented in the *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1777/V1&D2.

Four treatability studies have been conducted to investigate methods for reducing or remediating the VOC contamination in the C-400 area. The first, using a chemical cosolvent, was conducted in 1994 at the southeast corner of the C-400 area using the existing monitoring wells. The results are reported in *The In-Situ Decontamination of Sand and Gravel Aquifers by Chemically Enhanced Solubilization of Multiple-Component DNAPLs with Surfactant Solutions*, submitted by Intera Inc., in January 1995. The next two studies were bench scale studies conducted as part of the WAG 6 RI. One looked at other surfactants and co-solvents, while the other evaluated chemical oxidation. The results of these studies are documented in *Surfactant Enhanced Subsurface Remediation Treatability Study Report for the Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1787&D2, and in *Bench Scale In-Situ Chemical Oxidation Studies of Trichloroethene in Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1788&D2, respectively. The fourth treatability study was a test of electrical resistance heating, specifically the Six-Phase Heating technology, at the southeast corner of the C-400 area, conducted in 2003. Two actions have remediated some of the soil contamination near the southeast corner of C-400. After the discovery of the TCE leak in June 1986, some of the soils were excavated in an attempt to reduce the contamination in the area. Excavation was halted to prevent structural damage to the adjacent TCE storage tank and to 11th

Street. Approximately 310 ft^3 of TCE-contaminated soil was drummed for off-site disposal. The excavation was backfilled with clean soil and the area was capped with a layer of clay. During the 2003 Six-Phase Heating Treatability Study, it is estimated that over 22,000 pounds of TCE were removed from the subsurface in the southeast corner of the C-400 area. No other remedial actions have been performed. The preferred alternative identified in this plan will reduce VOC contamination in the soil and groundwater at C-400.

SITE CHARACTERISTICS

In the area of C-400, the topography is relatively flat, with elevations ranging from approximately 370 to 376 ft above mean sea level. Thick concrete aprons cover the heavy traffic areas immediately north and south of the building, while gravel or asphalt covers the areas on the east and west sides of the building. A variety of utility lines are buried on all sides of the building. An active railroad track serves the south side of the building, and an overhead gantry crane and loading dock also are present along the south side of the building. Aboveground steam lines run along the west side of the building. Most of the storm water from the C-400 area flows to storm drain inlets around the building and discharges via the storm sewer on the south side of the building to Outfall 008, then to Bayou Creek on the west side of the plant. Runoff from the north side of C-400 flows into the North-South Diversion Ditch, then is pumped to the C-616 Lagoons and released through Outfall 001 to Bayou Creek.

The C-400 area is underlain by a sequence of clay, silt, sand, and gravel layers deposited on limestone bedrock. As shown in Fig. 2, the sediments above the limestone bedrock are grouped into three major stratigraphic units (loess, continental deposits, and McNairy Formation), based on how the sediments were deposited, and three major hydrogeologic units (HUs) (the UCRS, the RGA, and the McNairy Flow System), based on how water moves within the sediments. The first stratigraphic unit consists of fill and a layer of wind-deposited, silty clay, or loess, extending from the surface to a depth of approximately 20 ft. Beneath the loess, the upper continental deposits, a subunit of the continental deposits consisting of discontinuous sand and gravel layers interbedded with silt and clay, extend to an average depth of 55 ft bgs.

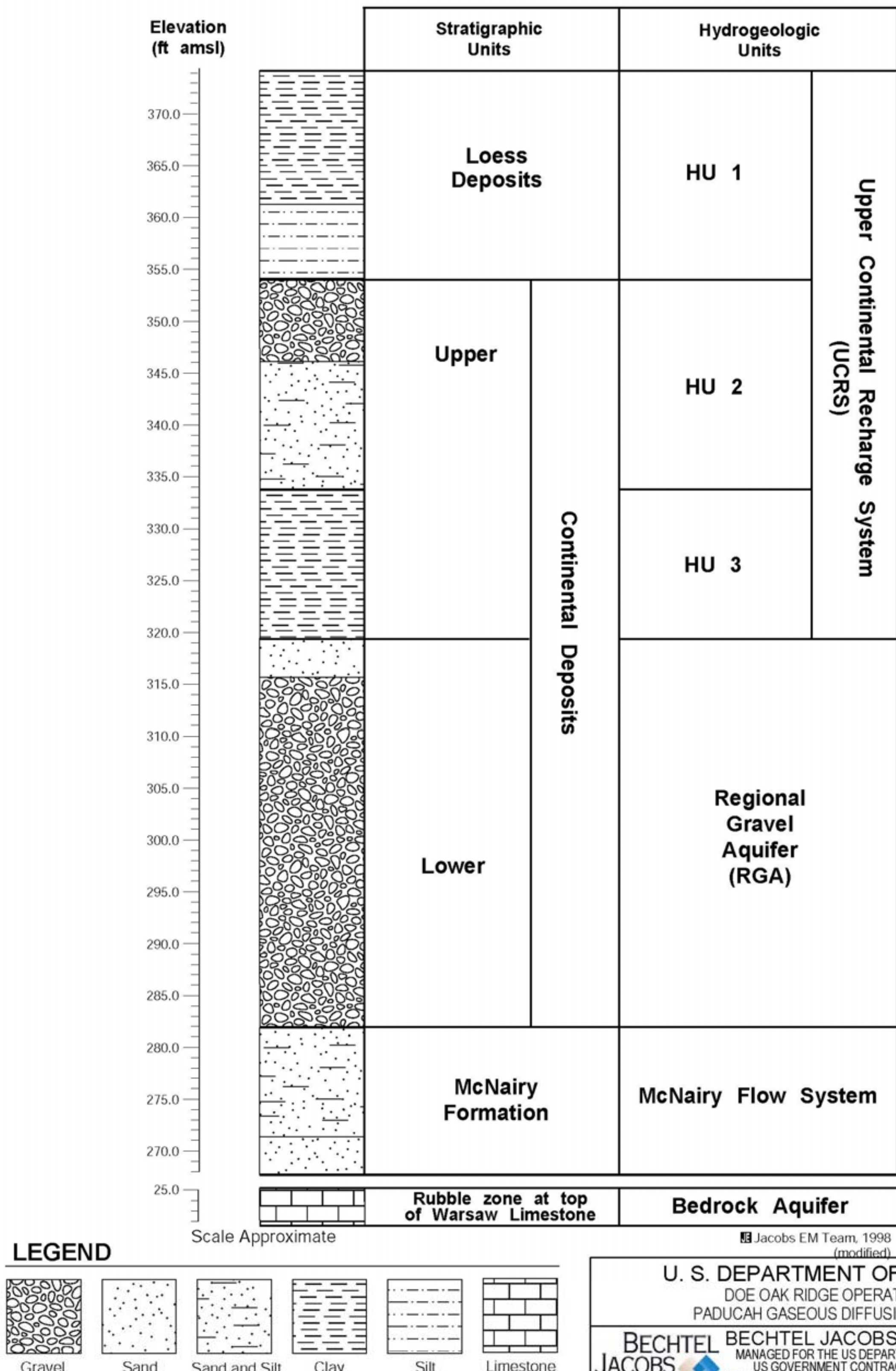
The lower continental deposits, also a subunit of the continental deposits, is a highly permeable layer of gravelly sand or chert gravel, typically extending from approximately 55 to 92 ft bgs. Below the continental deposits is the McNairy Formation, a sequence of silts, clays, and fine sands that extends from approximately 92 to 350 ft bgs. The shallow groundwater system at the site, the UCRS, is subdivided into the HU1, HU2, and HU3 units and consists of the loess (HU1) and the underlying upper continental deposits (HU2 and HU3). The sand and gravel lenses of the HU2 unit are separated from the underlying RGA by a 12- to 18-ft-thick silty or sandy clay interval designated the HU3 aquitard (Fig. 2). The aquitard restricts the vertical flow of groundwater from the sands and gravels of the HU2 unit to the gravels of the RGA. In some limited areas, notably the southeast corner of C-400, the HU3 aquitard is considerably thinner and a lesser barrier to groundwater movement. The RGA, the uppermost aquifer in the C-400 area, consists of the lower continental deposits stratigraphic unit. Below the RGA is the McNairy Flow System, which corresponds to the McNairy Formation. The uppermost portion of the McNairy Flow System typically is a clay or silty clay, which acts as an aquitard restricting groundwater flow between the RGA and McNairy Flow System.

The depth of the shallow water table within the UCRS varies considerably across PGDP. In the C-400 area, ground covers and engineered drainage limit rainfall infiltration. The shallow water table generally is encountered at depths of approximately 40 to 50 ft bgs. Water within the UCRS tends to flow downward to the RGA. Groundwater flow in the RGA generally is to the north, eventually discharging into the Ohio River. At the C-400 area, groundwater flow is generally to the northwest as part of the Northwest Plume, although there is evidence for some divergent flow to the east and possibly to the west as part of the Northeast and Southwest Plumes, respectively.

Nature and Extent of Contamination

The following section provides a brief summary of the nature and extent of the VOC contamination at C-400 that is being addressed by this action. More detailed information is in the *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, DOE/OR/07-1727/V1&D2. This document (which is a part of the Administrative Record for this PRAP) can be examined at the DOE Environmental Information Center.

Sampling conducted during the WAG 6 RI at the C-400 area indicates that the primary site-related contaminants in subsurface soil and groundwater at the unit are



U. S. DEPARTMENT OF ENERGY
DOE OAK RIDGE OPERATIONS
PADUCAH GASEOUS DIFFUSION PLANT

BECHTEL JACOBS
Bechtel Jacobs Company LLC
BECHTEL JACOBS COMPANY, LLC
MANAGED FOR THE US DEPARTMENT OF ENERGY UNDER
US GOVERNMENT CONTRACT DE-AC05-03OR22980
Oak Ridge, Tennessee • Paducah, Kentucky • Portsmouth, Ohio

SAIC
Science Applications International Corporation
P.O. Box 2502
Oak Ridge, Tennessee 37831

Fig. 2. Hydrogeologic units.

FIGURE No. DO-177 C-400 Proposed Plan\\D0R3 PRAP\Fig_2R3.pdf
DATE 11-25-03

TCE and its breakdown products (*cis*-1,2-dichloroethene [*cis*-1,2-DCE], *trans*-1,2-DCE, and vinyl chloride) and 1,1-DCE. Other VOCs found during the WAG 6 RI include tetrachloroethene, carbon tetrachloride, chloroform, 1,1,1-trichloroethane (TCA), 1,1,2-TCA, and toluene.

The highest concentrations of VOCs in the soil (Table 1) were found in the southeast and southwest sectors (Sectors 4 and 5, respectively) of the C-400 area. The southeast sector contains SWMU 11 and the TCE transfer pumps and piping. The southwest sector contains an area of soil contamination that has not been linked to a particular C-400 process. Smaller, less significant areas of VOC soil contamination were identified on the east and west sides of C-400, as well as near the northwest corner of the building.

Table 1. Maximum VOC contaminant levels in soils at C-400

CONTAMINANT	Contaminant levels (mg/kg) in soil	
	Southeast corner area	Southwest corner area
TCE	11,055	168
Trans-1,2-DCE	102	15
Vinyl chloride	29	<1
Cis-1,2-DCE	2	1
1,1,1-TCA	2	<1
1,1-DCE	<1	<1

The elevated concentrations of TCE and its breakdown products in subsurface soils suggest that dense nonaqueous-phase liquid (DNAPL) source areas exist within the UCRS soils of the southeast and southwest sectors of the C-400 area. DNAPLs are liquid chemicals that do not readily dissolve in water and are denser than water. Once in the ground, DNAPLs can migrate downward through the subsurface, with a portion being trapped in the pore spaces in the soil and the remaining portion continuing to migrate downward. The TCE concentrations detected in the RGA during the WAG 6 RI, a maximum of 701 mg/L in groundwater (64% of the maximum solubility of TCE in water) in the southeast sector, suggest that the DNAPL has penetrated the RGA and is acting as a secondary source of groundwater contamination.

SCOPE AND ROLE OF THE RESPONSE ACTION

The GWOU is one of five operable units at PGDP being used to evaluate and implement remedial actions. The scope of this response action encompasses surface and subsurface sources contributing to contamination of the GWOU. The goal of this response action is to reduce DNAPL mass at VOC source areas of the C-400 area to reduce further contribution to the off-site plumes. The completion of this action will contribute to the goal of eventual groundwater remediation.

Past actions to address groundwater contamination from the plant include a Water Policy action that provides municipal water service to all residences within the area that may be impacted by the contaminated groundwater. In addition, DOE has undertaken interim actions involving hydraulic containment of the high concentration cores of the Northeast and Northwest Plumes to limit further spreading of the contamination. The proposed remedial action would result in treatment of source area contamination at the C-400 area. The levels of TCE contamination in these areas suggest that TCE exists as DNAPL in the UCRS and RGA at these locations. Reducing, removing, or containing TCE in soil at C-400 will reduce the time frame that TCE concentrations in the off-site plumes remain above health-based levels. The proposed action will use treatment to permanently reduce the toxicity, mobility, and volume of the VOC contamination at C-400 that constitutes principal threat source materials (PTSM). (PTSM is a term used for contamination that is an obvious threat to human health and the environment, due either to the nature and concentration of contamination or to a large mass of leachable material in the ground. At C-400, the VOC contamination is a PTSM because of toxicity, concentration, and ability to migrate through groundwater.)

This source reduction action is an interim remedial action. All of the remedial alternatives require additional measures, such as land use controls (LUCs), to protect human health. It is expected that some residual contamination will remain in DNAPL source areas after implementation of the preferred action. These DNAPL source areas will be subject to

WHAT IS RISK AND HOW IS IT CALCULATED?

A CERCLA human health risk assessment estimates “baseline risk.” This is an estimate of the likelihood of health problems occurring under realistic current and future use if no cleanup action is taken at a site. To estimate the baseline risk at a CERCLA site, a four-step process is followed.

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the risk assessor looks at the concentrations of contaminants found at a site, as well as at past scientific studies on the effects these contaminants have had on people (or animals, when human health studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies enable the risk assessor to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the risk assessor considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, the risk assessor calculates dose from a “reasonable maximum exposure” (RME) scenario, which represents an estimate of the highest level of human exposure that reasonably could be expected to occur within a given time period.

In Step 3, the risk assessor uses the information from Step 2, combined with the information of the toxicity of each chemical, to assess potential health risks. Two types of risk are considered: cancer risk and noncancer risk. The likelihood of any kind of cancer resulting from a CERCLA site generally is expressed as an upper bound probability: for example, a “1 in 10,000 chance.” In other words, for every 10,000 people exposed under the RME scenario, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than normally would be expected from all other causes. For noncancer health effects, the risk assessor calculates a “hazard index” (HI). The key concept for noncancer health effects is that a “threshold level” (measured as a HI of 1) exists; below this level, noncancer health effects are not expected.

In Step 4, the risk assessor determines whether the site risks are great enough to cause unacceptable health problems for people exposed at or near a site. To do this, the risk assessor combines and summarizes the risk results for the individual chemicals and routes of exposure within the RME scenario and compares the resulting scenario risk estimates to the generally acceptable risk range for site-related exposures.

continued groundwater monitoring and long-term land-use restrictions to prevent exposure under current, and potential future, land-use activities. Data will be collected to verify the accomplishment of the remedial objectives. When applicable regulations and requirements cannot be cost-effectively achieved, certain options may be available, including technical impracticability and interim measure waivers, as well as alternate concentration limits.

SUMMARY OF SITE RISKS

The human health and ecological risks posed by contamination found at or migrating from a site determine whether a remedial action is warranted. This section of the PRAP presents a summary of the baseline risk assessments performed for the C-400 area in the WAG 6 RI and the GWOU FS. This summary describes the nature and extent of the risks posed to human health and the environment by the VOC contamination found in subsurface soil and groundwater at the C-400 area that will be addressed by the proposed action. This discussion is presented in two subsections: human health risks and ecological risks.

Based upon the baseline risk assessment’s results, the preferred alternative would contribute to protection of human health and welfare or the environment from actual or threatened releases of pollutants, contaminants, or hazardous substances. These actual or threatened releases may present imminent and substantial danger to public health or welfare.

Human Health Risks

The baseline human health risk assessments considered both the current and potential future uses of the C-400 area and the areas to which contaminants from the site may migrate. Currently, the C-400 area lies within the industrialized areas of PGDP. Under current plans, the C-400 area is expected to remain industrial, with groundwater use restrictions in the future. It is not reasonable, therefore, to assume that groundwater would be withdrawn from the C-400 area and used for any purpose other than monitoring. However, consistent with EPA risk assessment guidance, hypothetical baseline risks were calculated under the assumption of use of this water by residents and industrial workers for drinking and washing. Based on this approach, risks were determined to be unacceptable. Of greater importance is the potential for the contaminants in soil and groundwater to migrate to areas where groundwater may be used in the future. To address this concern, the baseline human health risk assessments used results from fate and transport modeling to estimate the potential risks that could be posed to a hypothetical resident drawing water from a well completed in the RGA at the PGDP property boundary. This analysis determined that three VOCs, TCE, vinyl chloride, and 1,1-DCE, could present unacceptable cancer risks and hazards if groundwater contaminated by these VOCs were used in the home (for consumption and washing) of the hypothetical resident. (As noted earlier, previous actions for the GWOU [i.e., the Water Policy] prevent exposure to contaminated groundwater by current residents.) The maximum predicted concentration of these VOCs, their predicted concentrations in groundwater in the RGA at the PGDP property boundary, and maximum potential cancer risk and hazard are discussed below. (Note that the potential cancer risks and hazards presented here were calculated using toxicity values that are updated from those used in the WAG 6 RI and GWOU FS, based on guidance from EPA.)

<u>TCE</u>: The maximum predicted concentrations in groundwater in the RGA at the PGDP property boundary from sources in subsurface soil and the RGA in the C-400 area are 31.7 mg/L and 7.1 mg/L, respectively. The estimated potential cancer risk and HI to a hypothetical resident exposed to the higher concentration (31.7 mg/L) are 2 in 100 and 2,000, respectively.

<u>Vinyl Chloride</u>: The maximum predicted concentration in groundwater in the RGA at the PGDP property boundary from sources in subsurface soil in the C-400 area is 0.0007 mg/L. The estimated potential cancer risk and HI to a hypothetical resident are 2 in 100,000 and less than 1, respectively.

<u>1,1-DCE</u>: The maximum predicted concentration in groundwater in the RGA at the PGDP property boundary from sources in subsurface soil in the C-400 area is 0.0025 mg/L. The estimated potential cancer risk and HI to a hypothetical resident are 5 in 100,000 and less than 1, respectively.

WHAT ARE THE "CONTAMINANTS OF CONCERN"?

DOE has identified chemicals in the subsurface at the C-400 area that pose potential risk to human health through migration of contamination to groundwater. TCE is the contaminant of concern (COC) for this remedial action. Discussions of other COCs found in other environmental media may be found in the RI report for the C-400 area (i.e., WAG 6).

TCE is a halogenated organic compound used in the past for a variety of purposes at PGDP. During the WAG 6 RI, TCE was detected in subsurface soil in the C-400 area at concentrations up to 11,055 mg/kg and in RGA groundwater at concentrations up to 701 mg/L. Exposure to this compound has been associated with deleterious health effects in humans. Based on laboratory studies, TCE is a systemic toxicant and is considered a probable human carcinogen. Over time, TCE naturally degrades to other organic compounds. TCE currently is not used at PGDP.

These cancer risk and hazard results, which are based upon RME scenarios that considered use of contaminated groundwater in the home (i.e., consumption and washing), indicate that there could be a significant potential risk to children and adults from exposure to VOCs in groundwater from sources in the C-400 area. Most notable are the estimated potential cancer risks and hazards from exposure to TCE in groundwater, which exceed the upper limit of EPA's generally acceptable risk range for site-related exposures (i.e., a cancer risk equal to 10^{-4}) and the limit used by EPA to determine when noncancer risks may be unacceptable (i.e., an HI equal to 1). (Please see the text box located at the top of page 7.)

The potential cancer risks for vinyl chloride and 1,1-DCE fall within EPA's acceptable risk range. They were estimated to exceed the lower limit of EPA's generally acceptable risk range for site-related exposures (i.e., a cancer risk equal to 10^{-6}) but neither VOC has a maximum predicted concentration that exceeds its maximum contaminant level (MCL) under the Safe Drinking Water Act. The MCLs for vinyl chloride and 1,1-DCE are 0.002 and 0.007 mg/L, respectively, versus maximum predicted concentrations from fate and transport modeling of 0.0007 and 0.0025 mg/L, respectively. The maximum predicted concentration for TCE (31.7 mg/L) does exceed its MCL (0.005 mg/L) by a significant margin making TCE the COC to be addressed by the proposed action.

Ecological Risks

A screening ecological risk assessment indicated a small potential for significant ecological impacts to occur from exposure to the contamination considered in the PRAP. This was based upon the location of the contamination being addressed (i.e., in the subsurface) and the industrial nature of the units. Generally, the assessment concluded that there was little potential for significant exposure of wildlife to this contamination under current conditions; therefore, ecological risks were estimated to be below levels of concern.

REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) describe what the proposed site cleanup is expected to accomplish. The RAOs for the C-400 area are the following:

- Prevent exposure to contaminated groundwater by on-site industrial workers and recreational users and off-site residents;
- Reduce VOC contamination in UCRS soil at C-400 to minimize the migration of these contaminants to RGA groundwater and to off-site points of exposure; and
- Reduce the extent of the VOC source in the RGA in the C-400 area and the contained VOC concentrations to reduce the migration of these VOC contaminants to off-site points of exposure.

At C-400, this proposed action will achieve the RAOs by implementing enhanced institutional controls or removing VOC mass. Supplementing existing institutional controls will reduce risk to below levels of concern by preventing exposure, and implementing an action to remove VOC mass will result in less contaminant migration to off-site areas through the groundwater pathway and be a step toward meeting the overall goals of GWOU remediation at PGDP. (See *Scope and Role of the Response Action.*)

SUMMARY OF ALTERNATIVES

The following four remedial alternatives were assessed for application in the VOC DNAPL source areas of the UCRS and the RGA at C-400.

- No Action.
- Limited Action, consisting of institutional controls to prevent human exposure to the contaminants, five-year reviews, LUCs, and no additional contaminant removal or treatment. Enhanced institutional controls would restrict use of and access to the groundwater (e.g., implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use or acquisition of rights to groundwater).
- Direct heating in both the UCRS and the RGA to remove contaminants, five-year reviews, and LUCs.
- Vapor extraction in the UCRS and steam extraction in the RGA to remove contaminants, five-year reviews, and LUCs.

The preferred alternative is direct heating both in the UCRS and the RGA, five-year reviews, and LUCs. Note that all of the remedial alternatives require LUCs to achieve protection of human health.

Alternative 1: No Action

Under the No Action Alternative, active mass removal, treatment, or containment would not be performed. This remedial alternative provides a basis for assessing the effects of taking no action at C-400 and provides a baseline against which the other alternatives are compared. For evaluation purposes only, the scope of this alternative does not include continuation of any existing interim actions or existing institutional controls. Also, no groundwater monitoring would be conducted. (Note that existing interim actions [such as the Northwest and Northeast Plume pump-and-treat actions], the existing institutional controls [e.g., the Water Policy removal action and plant security measures], and the groundwater monitoring activities could continue, but they were not considered to be components within the scope of this remedial alternative.) Five-Year Reviews would be conducted since contamination would remain in place. Natural attenuation processes eventually would remove the contamination; however, the remediation time frame would be very long (thousands of years).

Alternative 2: Limited Action

Under the Limited Action Alternative, active mass removal, treatment, or containment would not be performed. However, other protective measures would be continued and enhanced to prevent human exposure to the contaminants in the UCRS and RGA. Existing institutional controls, such as the Water Policy and control of the C-400 area, would be maintained and augmented by additional actions to restrict use of and access to the groundwater (e.g., deed restrictions). Five-Year Reviews would be conducted, and groundwater monitoring would be continued. Natural attenuation processes eventually would remove the contamination; however, the remediation time frame would be very long (thousands of years).

Alternative 3: Direct Heating in both the UCRS and the RGA

Alternative 3 consists of volatilization and removal of contaminated groundwater and VOCs by application of Electrical Resistance Heating. The GWOU FS evaluated Electrical Resistance Heating for application in the UCRS. A contemporaneous innovative technology review identified Electrical Resistance Heating as a promising remedial measure to be tested in the RGA. The treatability study indicated that Electrical Resistance Heating can be effective in the RGA.

Two common applications of Electrical Resistance Heating are Three-Phase Heating and Six-Phase Heating. In both applications, this technology uses *in situ* (in place) heating to raise the temperature of the soil to a level where the target contaminant(s) is/are volatilized. Common power sources (60 hertz) may be used to heat the ground (typical subsurface applied voltages range from 150–600 volts), producing *in situ* steam to liberate the contaminants, which are removed by way of a vapor recovery system. The technology can be deployed in the vadose (above the water table) and saturated (below the water table) zones and may be used in moist soils with either low or high permeability.

The Three-Phase Heating system consists primarily of a network of inground electrodes and co-located vapor extraction wells distributed throughout the zone of contamination. Three-Phase Heating is the preferred electrical phasing method for large and noncircular remediation areas. Six-Phase Heating employs six electrodes located in a hexagonal shape with a neutral electrode located in the center of the hexagon serving as a vapor extraction well. It is the preferred electrical phasing method for smaller, discrete areas.

Alternative 3 includes the following components: (1) installation of the Electrical Resistance Heating array, (2) withdrawal of VOCs and steam by high vacuum (approximately 20 to 25 inches of mercury) extraction, (3) treatment of soil vapor and steam condensate, and (4) discharge of treated groundwater through a permitted Kentucky Pollutant Discharge Elimination System (KPDES) outfall. The operation of the Electrical Resistance Heating array will cease when the monitoring system indicates that heating has stabilized in the subsurface and the contaminant recovery diminishes to 100 ppm or less, as measured in the recovered vapor.

Alternative 4: Vapor Extraction in the UCRS and Steam Extraction in the RGA

Alternative 4 consists of the removal and treatment of contaminated groundwater and VOCs by application of a Dual-Phase Extraction System in the UCRS and a Steam Extraction System in the RGA.

Dual-Phase Extraction, also known as multi-phase extraction or vacuum-enhanced extraction, uses a high vacuum system to remove various combinations of contaminated groundwater, separate-phase VOC product, and soil vapor from low permeability and heterogeneous formations. The vacuum extraction well includes a screened section in the zone of contaminated soils and groundwater. In operation, the system lowers the water table around the well, dewatering the formation. Contaminants in the vadose zone then are accessible to vapor extraction. Once above the ground, the system separates and treats the extracted vapors, liquid-phase organics, and groundwater.

Steam Extraction requires a series of injection and extraction wells in the treatment area to inject steam into the subsurface. The injected steam volatilizes the VOC contaminants (converts the VOC contaminants from a liquid state to a vapor state by the application of heat). VOC-contaminated steam and water are collected in the extraction wells. An aboveground treatment system separates contaminants from the wastewater and gas prior to release.

Alternative 4 includes the following components.

<u>Dual-Phase Extraction</u>: (1) installation of recovery wells, (2) withdrawal of UCRS groundwater by pumping, (3) withdrawal of VOCs from the vadose zone by high vacuum (approximately 20-25 inches of mercury) extraction, (4) treatment of groundwater and

soil vapor, and (5) discharge of treated groundwater through a KPDES-permitted outfall.

Steam Extraction: (1) installation of injection and recovery wells, (2) injection of steam, (3) withdrawal of VOCs from the RGA in recovered steam and effluent water, (4) treatment of groundwater and steam, and (5) discharge of treated water through a KPDES-permitted outfall.

Remedial Action Location

Alternatives 3 and 4 include activities to determine the full areal and vertical extent of the C-400 contamination as part of the remedial design process. This determination will direct the placement of the remediation systems.

Five-Year Reviews and LUCs

Because contamination that is above levels that would prevent unrestricted use would remain on-site during and after implementation of each of the alternatives, CERCLA mandates continuing five-year reviews. LUCs for the purpose of precluding residential use of the C-400 source area also are an integral part of Alternatives 2, 3, and 4. These include property record notices and administrative and access controls to DOE property. Property record notices would alert anyone performing a search of property records to important information about contamination and response actions on the property. Administrative controls would include measures such as the current "excavation/penetration permit program," which requires workers to obtain formal authorization (i.e., internal permits/ approvals) before beginning any intrusive activities. Access controls could include measures such as fences, gates, and security activities determined to be necessary to ensure protectiveness after performance of response actions. The LUCs would incorporate deed restrictions to be implemented upon the transfer of DOE property (e.g., sale or lease).

Continued Groundwater Monitoring

Alternatives 2, 3, and 4 include continued groundwater monitoring until groundwater VOC levels are reduced to levels acceptable for beneficial use. Alternative 1, as the "No Action Alternative," does not include groundwater monitoring or the provision of public water to impacted residents.

EVALUATION OF ALTERNATIVES

The preferred remedial alternative is Alternative 3, Direct Heating in both the UCRS and the RGA, based on an evaluation of the nine criteria established by the National Oil and Hazardous Substances Contingency Plan. The criteria are derived from the statutory requirements of CERCLA Section 121. This PRAP documents the evaluation of the first seven criteria; the final two criteria (state and community acceptance) will be addressed after public comment. Brief descriptions of all nine criteria follow.

Threshold Criteria (standards that must be met for an action to be eligible for selection):

1) **Overall protection of human health and the environment**. This criterion requires that the remedial alternative adequately protect human health and the environment, in both the short-term and long-term. The elimination, reduction, or control of unacceptable risks must be demonstrated.

2) **Compliance with applicable or relevant and appropriate requirements (ARARs).** This criterion specifies that the remedial alternative be assessed to determine if it will comply with ARARs of both state and federal law to the extent practicable. If the action is an interim action, CERCLA requires the action to meet ARARs to the extent practicable.

Balancing Criteria (standards for measure of balance between effectiveness and reduction of toxicity, mobility, or volume through treatment; implementability; and cost):

3) **Long-term effectiveness and permanence.** This criterion focuses on the level of risk remaining after implementing the remedial alternative and the adequacy and reliability of controls used to manage remaining waste (untreated waste and treatment residuals) over the long-term (i.e., after remedial objectives are met). Remedial actions that produce the highest degree of long-term effectiveness and permanence are those that leave little or no waste at the site, make long-term maintenance and monitoring unnecessary, and minimize the need for institutional controls.

4) **Reduction of contaminant toxicity, mobility, or volume through treatment.** This criterion evaluates the degree to which the remedial

alternative makes use of recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

5) **Short-term effectiveness.** This criterion assesses the effect of implementing the remedial alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required until protection is achieved.

6) **Implementability.** This criterion evaluates potential difficulties associated with implementing the remedial alternative, including technical feasibility, administrative feasibility, and the availability of services and materials.

7) **Cost.** This criterion measures the estimated costs of the remedial alternative. Expenditures include the capital cost and annual operation and maintenance (O&M) costs.

Modifying Criteria (standards to address state and community acceptance):

8) **State Acceptance.** This criterion provides for consideration of any formal comments on this PRAP by the Commonwealth of Kentucky.

9) **Community Acceptance.** This criterion provides for consideration of any formal comments from the community on this PRAP.

Table 2 presents a comparison of the remedial alternatives for the first seven criteria. Criteria 8 and 9 will be evaluated after the public comment period and presented in the "Responsiveness Summary" section of the ROD. The estimated cost for each alternative is derived from the GWOU FS, assuming that the source zones to be remediated extend through the UCRS and the RGA over a combined area of 0.5 acres, as defined by the WAG 6 RI map of maximum TCE concentration in UCRS soils. Alternatives 3 and 4 include data collection for determining placement of the remedial action as part of the remedial design. The estimated cost of gathering the data for determining placement will be $1,110,000.

Overall protection of human health and the environment. Since Alternative 1 would not prevent exposure to the contaminants, it does not meet the threshold criterion of providing overall protection of human health and the environment. Based on the result of the detailed analysis, Alternatives 2, 3, and 4 meet the threshold criterion of overall protection of human health and the environment when combined with restrictions on groundwater use. The goal of Alternative 2 is to prevent exposure to human receptors. The goal of both Alternatives 3 and 4 is to remove DNAPL mass at major source areas, thereby reducing the time frame that TCE concentrations in the off-site plumes remain above health-based levels. Alternatives 3 and 4 will leave residual amounts of DNAPL in the treated source zones that likely will continue to result in unacceptable TCE levels in groundwater (levels greater than the MCL). At the completion of the remedial alternatives 2, 3, or 4, a follow-on action may consist of monitored natural attenuation (consisting of an assessment of the rate of natural degradation of the residual contaminants), continued groundwater monitoring, and LUCs.

Compliance with ARARs. Alternative 1 would not result in VOC reductions in the source zones and, therefore, may be considered not to be compliant with ARARs. Alternatives 2, 3, and 4 will meet location-specific ARARs and the identified action-specific ARARs except for the requirement to achieve MCLs for VOCs. However, Alternatives 2, 3, and 4 satisfy the requirement for interim remedial actions to meet ARARs to the extent practicable. Alternatives 3 and 4 would lead to quicker VOC reductions in the source zones that allow for significantly shorter timeframes than those associated with Alternatives 1 and 2. (hundreds of years versus thousands of years). This remedial action will address only VOCs in the treatment area. Additional measures may be required to address other contaminants such as metals and ^{99}Tc in order to meet their applicable ARARs.

Long-term effectiveness and permanence. Alternatives 1 and 2 do not meet the balancing criteria for long-term effectiveness and permanence, since contaminants that might migrate into the environment would remain in place over thousands of years.

Alternatives 3 and 4 meet the criterion for long-term effectiveness and permanence, since both alternatives speed the remediation time frame by treatment of VOC contamination at C-400. Alternatives 1, 2, 3, and 4 will require five-year reviews.

Reduction of toxicity, mobility, or volume through treatment. Alternatives 1 and 2 do not include any

Table 2. Comparison of remedial alternatives

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Limited Action *	Alternative 3: Direct Heating in the UCRS and RGA and LUCs	Alternative 4: Vapor Extraction in the UCRS and Steam Extraction in the RGA and LUCs
Overall Protection of Human Health and the Environment	Not protective.	Protective via continuing institutional controls and LUCs. Existing VOCs would remain in the UCRS and RGA for over 100 years.	Protective with LUCs for the C-400 area, based on limited scope of this remedial action. VOCs removed from both the UCRS and RGA.	Protective with LUCs for the C-400 area, based on limited scope of this remedial action. VOCs removed from both the UCRS and RGA.
Compliance with ARARs	Would not comply with ARARs. Chemical-specific ARARs waivers will be required.	Alternative is an interim action. Compliance with ARARs will be to the extent practicable.	This action would be conducted in accordance with action-specific ARARs to the extent practicable. This action would satisfy chemical-specific ARARs for groundwater to the extent practicable and it would significantly reduce the VOC mass.	This action would be conducted in accordance with action-specific ARARs to the extent practicable. This action would satisfy chemical-specific ARARs for groundwater to the extent practicable and it would significantly reduce the VOC mass.
Long-Term Effectiveness and Permanence	Not effective for at least 100 years. Five-year reviews required	Not effective for at least 100 years; five-year reviews required.	Effective in removing a large mass of VOCs.	Effective in removing a large mass of VOCs.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.	No treatment.	Reduced VOC mass through Electrical Resistance Heating Extraction and treatment.	Reduced VOC mass through Dual-Phase Extraction in the UCRS and Steam Extraction in the RGA and treatment.
Short-Term Effectiveness	Ineffective.	Effective and would not pose any additional risks during implementation	Steam, electrical, drilling, and construction hazards to workers may be present during the design investigation and implementation of the action. Would not pose any additional risks to the public during implementation.	Steam, drilling, and construction hazards to workers may be present during the design investigation and implementation of the action. Would not pose any additional risks to the public during implementation.
Implementability	Easily implemented.	Acquisition of rights to restrict access to contaminated groundwater could be difficult to implement.	Feasible to implement, but vendors are limited. Assumes on-site and off-site disposal facilities are available.	Feasible to implement, assuming on-site and off-site disposal facilities are available.
Cost (estimated)	Capital Cost: $0 Total O&M: $628,000	Capital Cost: amount necessary to implement enhanced institutional controls* Total O&M: $5,489,000 to an amount necessary to implement enhanced institutional controls	Capital Cost: $32,815,400 Total O&M: ** $ 8,525,350	Capital Cost: $65,040,050 Total O&M: ** $ 10,841,975

* Alternative 2 includes enhanced institutional controls on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to acquisition of rights from surrounding property owners and directly implementing restrictions on groundwater and property use.
** O&M costs for Alternatives 3 and 4 include confirmatory sampling.

ARAR = applicable or relevant and appropriate requirement
RGA = Regional Gravel Aquifer
LUCs = Land Use Controls
UCRS = Upper Continental Recharge System
O&M = operations and maintenance
VOCs = volatile organic compounds

active treatment; therefore, they do not satisfy the statutory preference for treatment. Alternatives 3 and 4 will provide treatment.

Short-term effectiveness. For the short-term effectiveness criterion, Alternatives 1 and 2 would not pose any additional risks to workers or the community during implementation. Since Alternatives 3 and 4 include a remedial design investigation and on-site treatment, there may be slight increases in risk exposure to the community and on-site workers during implementation; however, these risks are manageable by adherence to health and safety requirements and PGDP procedures.

Implementability. All four of the alternatives are technically and administratively feasible to implement. Alternatives 3 and 4 assume that on-site and off-site disposal capacity is readily available for the treatment residuals.

Cost. Since Alternative 1 is a No Action Alternative, there are no capital costs associated with implementation; however, five-year reviews would be required for 30 years at a total cost of $628,000. Alternative 2 costs would vary depending on the level of LUCs implemented. This cost would range from the lowest expected LUCs (i.e., continued Water Policy and five-year reviews) to higher amounts for implementing enhanced institutional controls.

Alternative 4 has higher capital and O&M costs than Alternative 3. The projected capital costs are $32,815,400 for Alternative 3 and $65,040,050 for Alternative 4. Estimated annual O&M costs are $8,525,350 (including $5,489,000 to continue five-year reviews and the Water Policy) for Alternative 3. Estimated annual O&M costs are $10,841,975 (including $5,489,000 to continue five-year reviews and the Water Policy) for Alternative 4.

SUMMARY OF THE PREFERRED ALTERNATIVE

The preferred alternative is Direct Heating, as Electrical Resistance Heating, based on its demonstrated ability to remove VOCs from soil and groundwater in UCRS and the RGA source areas.

The 2003 Six-Phase Heating Treatability Study demonstrated that Electrical Resistance Heating is capable of achieving reduction of DNAPL in the UCRS and can significantly reduce TCE levels in the RGA groundwater at C-400, although MCLs will not be met. Alternative 4 also would result in DNAPL mass removal, but at a higher cost.

Soil cuttings from the installation of wells and electrodes, wastewater, and treatment residuals will be the primary wastes generated during the implementation of this alternative. These wastes will be stored and treated and/or disposed of in appropriate storage and treatment and/or disposal facilities.

Preliminary Identification of Preferred Alternative Design Criteria and Considerations

Design and construction considerations applicable to Electrical Resistance Heating include the following:

- Extent of VOC source zone contamination in the UCRS and the RGA;
- Spacing and placement of electrodes and extraction wells to achieve optimum removal efficiency;
- Electrical conductivity of the soil being treated;
- Location of a local power supply;
- Sizing of treatment systems, pumps, and demisting system for soil vapor;
- Water treatment system discharge;
- Air emissions; and
- Waste classification for on-site versus off-site disposal.

Time Frame for Design and Implementation of Preferred Alternative

CERCLA requires that the site initiate fieldwork in support of remedial actions within 15 months of the approval of the ROD. The goal of the site is to accelerate design and work schedules to complete remedial actions as soon as possible.

O&M and Long-Term Monitoring Requirements

O&M requirements for Electrical Resistance Heating systems include routine maintenance of pumps, electrodes, pipes, gauges, and treatment units. Depending on the moisture content of the soil, it may be necessary to add small amounts of potable water to the electrodes. The voltage control system and transformers may require maintenance during operation. At the end of the treatment period, the Electrical Resistance Heating system will be decontaminated and decommissioned. No long-term O&M of the treatment system will be required. The successful application of Electrical Resistance Heating is expected to reduce the mass of VOCs in the C-400 DNAPL source zones of the UCRS and achieve significant DNAPL mass removal from the RGA. Residual VOC DNAPL will continue to contaminate groundwater, requiring long-term groundwater monitoring, until follow-on actions achieve acceptable contaminant levels.

This remedial alternative will result in "contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure"; therefore, this remedial action will be reviewed "no less often than every five years," in accordance with federal regulations [40 *CFR* 300.430 (F)(4)(ii)].

Land Use Controls

The LUC Implementation Plan (LUCIP) for any LUCs selected as part of this action will be consistent with the *LUC Assurance Plan (LUCAP) for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1799&D2. This LUCIP will be submitted for EPA and KDEP review and approval. Upon final approval, the LUCIP will be appended to and become part of the LUCAP and will establish LUC implementation and maintenance requirements enforceable under CERCLA and the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707.

COMMUNITY PARTICIPATION

Community involvement is a critical aspect of the cleanup process at PGDP. The DOE, EPA, and Commonwealth of Kentucky encourage the public to read and comment on this PRAP. Information regarding the proposed action has been presented to the PGDP Citizens Advisory Board. The preferred alternative discussed in this document represents a preliminary decision that is subject to public comment. A Notice of Availability will be published in *The Paducah Sun* announcing the 45-day public review period for this document. A public comment period will be scheduled after approval of the PRAP.

A public meeting will be conducted if requested in writing. All comments at the meeting will be recorded. The Kentucky Department for Environmental Protection, Division of Waste Management, will conduct a public hearing immediately following the public meeting, if requested. A hearing is a formal gathering during which public comments are recorded officially by a hearing officer (to be designated by the Kentucky Natural Resources and Environmental Protection Cabinet), as required by RCRA and Kentucky Hazardous Waste regulations. Written requests for a public hearing should state the issues to be discussed. If either a meeting or a hearing is requested, a notice will appear in *The Paducah Sun*. To request a public meeting and/or submit comments on this PRAP, please contact the Paducah DOE Site Office, P.O. Box 1410, Paducah, KY 42001, phone (270) 441-6800. To request a public hearing and/or submit comments on this "Statement of Basis," please contact Tony Hatton, Kentucky Department for Environmental Protection, Division of Waste Management, 14 Reilly Road, Frankfort, KY 40601, phone (502) 564-6716.

This document serves both as a Proposed Remedial Action Plan and as a Statement of Basis.

To send written comments or obtain further information about this Proposed Remedial Action Plan, contact:

U. S. Department of Energy
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001
(270) 441-6800

To send written comments about this Statement of Basis, contact:
Tony Hatton
Kentucky Department for Environmental Protection
Division of Waste Management
14 Reilly Road
Frankfort, KY 40601
(502) 564-6716

Administrative Record Availability

Information about this site considered during the response action determinations for this project, including the Proposed Remedial Action Plan, is available for review at the
DOE Environmental Information Center
115 Memorial Drive, Barkley Centre
Paducah, KY 42001
(270) 554-6979

Hours: 9:00 A.M. to 5:00 P.M. Monday through Friday

The Proposed Remedial Action Plan also is available at the
McCracken County Public Library
555 Washington Street, Paducah, KY 42001
(270) 442-2510

Hours: 9:00 A.M. to 9:00 P.M. Monday through Thursday
9:00 A.M. to 6:00 P.M. Friday and Saturday
1:00 P.M. to 6:00 P.M. Sunday

or contact:

Kentucky Department for Environmental Protection
Division of Waste Management
14 Reilly Road, Frankfort, KY 40601
Attention: Matthew Hackathorn
(502) 564-6716

(Record reviews at the Kentucky Department for Environmental Protection are by appointment only.)

United States Environmental Protection Agency
61 Forsyth Street, S.W., Atlanta, GA 30303-8960
Attention: David Williams (4 WD-FFB)
David.Williams@epamail.epa.gov
(404) 562-8550

The ROD and the proposed modification to the Kentucky Hazardous Waste Management Permit will be made available at the Environmental Information Center and at the Paducah Public Library after they have been signed by the United States Department of Energy, the United States Environmental Protection Agency, and the Kentucky Department for Environmental Protection.

The United States Department of Energy, the United States Environmental Protection Agency, and the Kentucky Natural Resources and Environmental Protection Cabinet do not discriminate upon the basis of race, color, national origin, sex, age, religion, or disability in the provision of services. Upon request, reasonable accommodations will be provided. These accommodations include auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all services, programs, and activities. To request appropriate accommodations for a public hearing or meeting (such as an interpreter) or alternate formats for printed information, contact Matthew Hackathorn at (502) 564-6716 or Greg Cook at (270) 441-5023.